

$$GFR = L_p S (\Delta P - \Delta \pi)$$

L_p : glomerular capillary wall permeability

S : total glomerular capillary surface area

ΔP : hydrostatic pressure gradient ($P_{GC} - P_{BS}$)

$\Delta \pi$: oncotic pressure gradient ($\pi_{GC} - \pi_{BS}$)

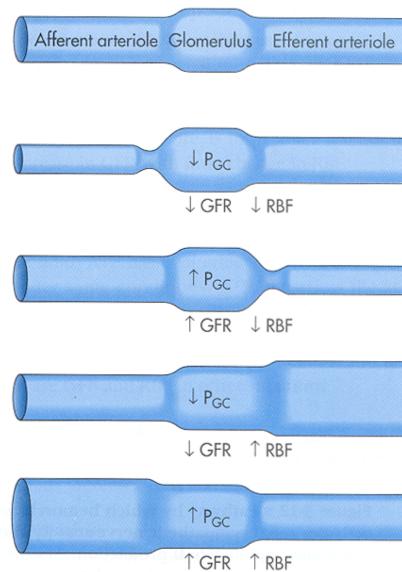
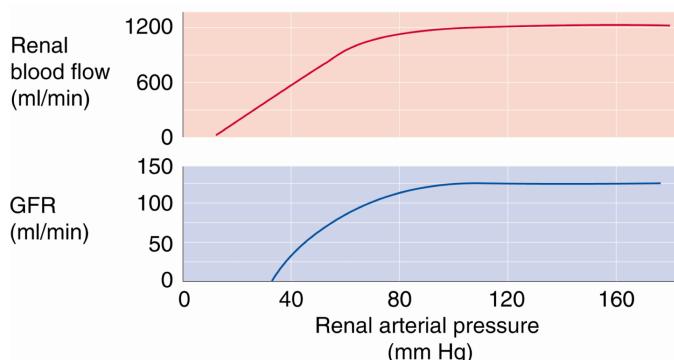
Modulation of $L_p S$

- Mesangial cell contraction

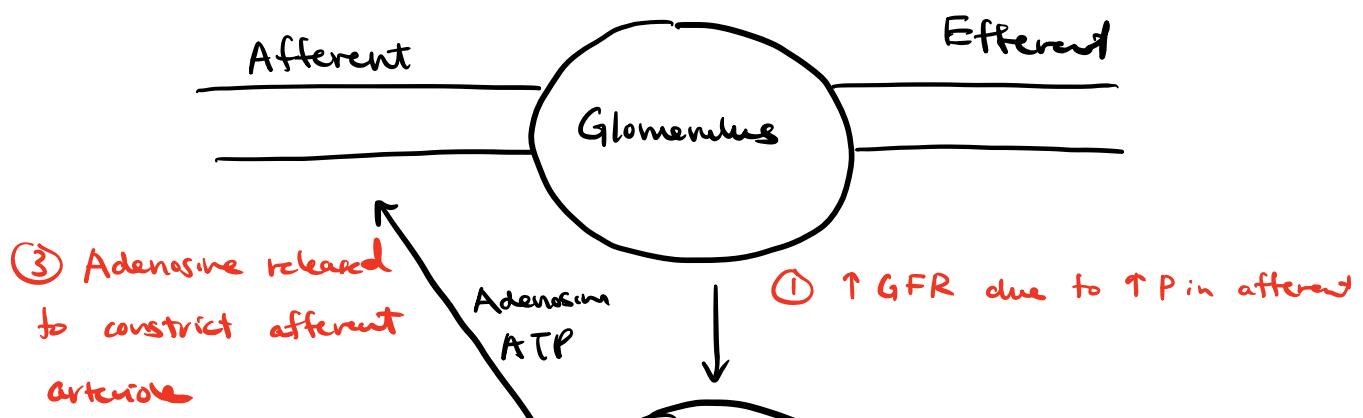
Modulation of P_{GC}

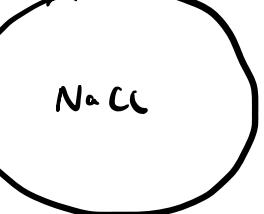
- Renal artery pressure
- Afferent / Efferent arteriole tone

Renal flow auto-regulated



Tubuloglomerular Feedback

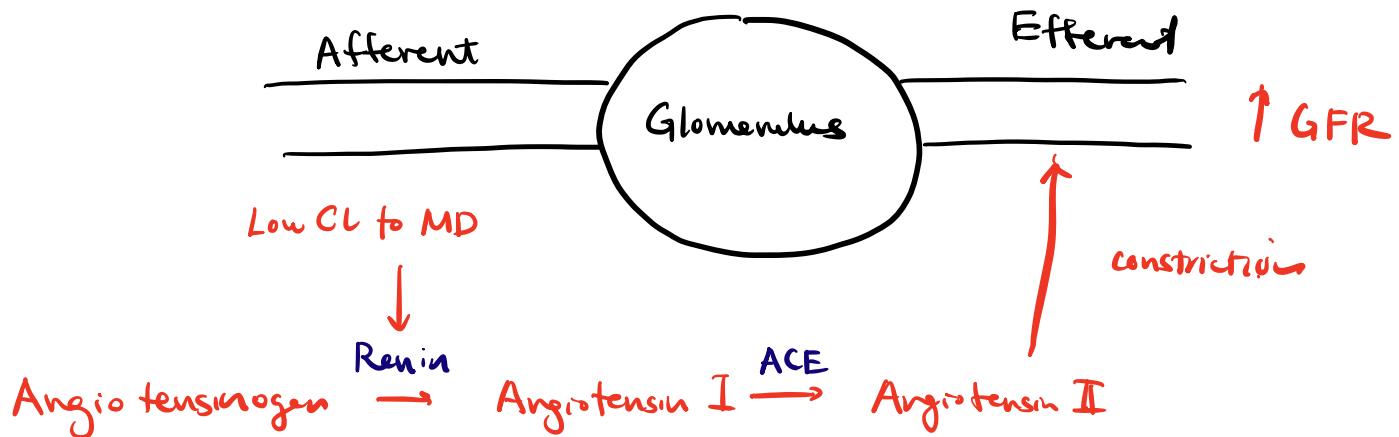




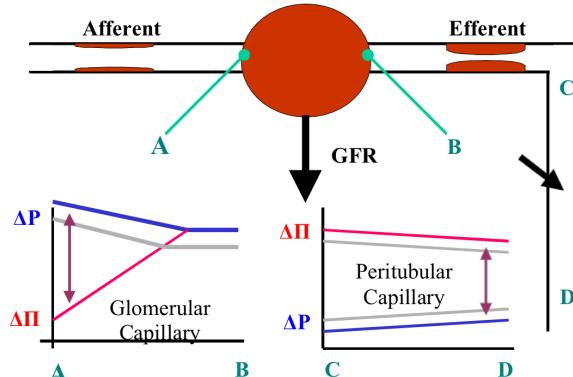
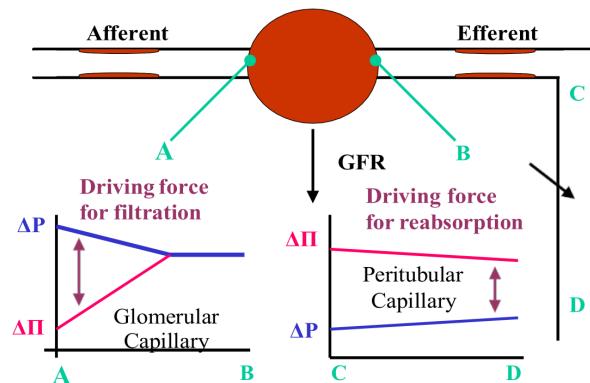
② ↑ NaCl delivery to Macula Densa

Macula Densa

Angiotensin II Effect



Glomerulotubular Balance



VASOconstriction at efferent → ↑ ΔP
 ↓ $\Delta \Pi$ → fluid reabsorption

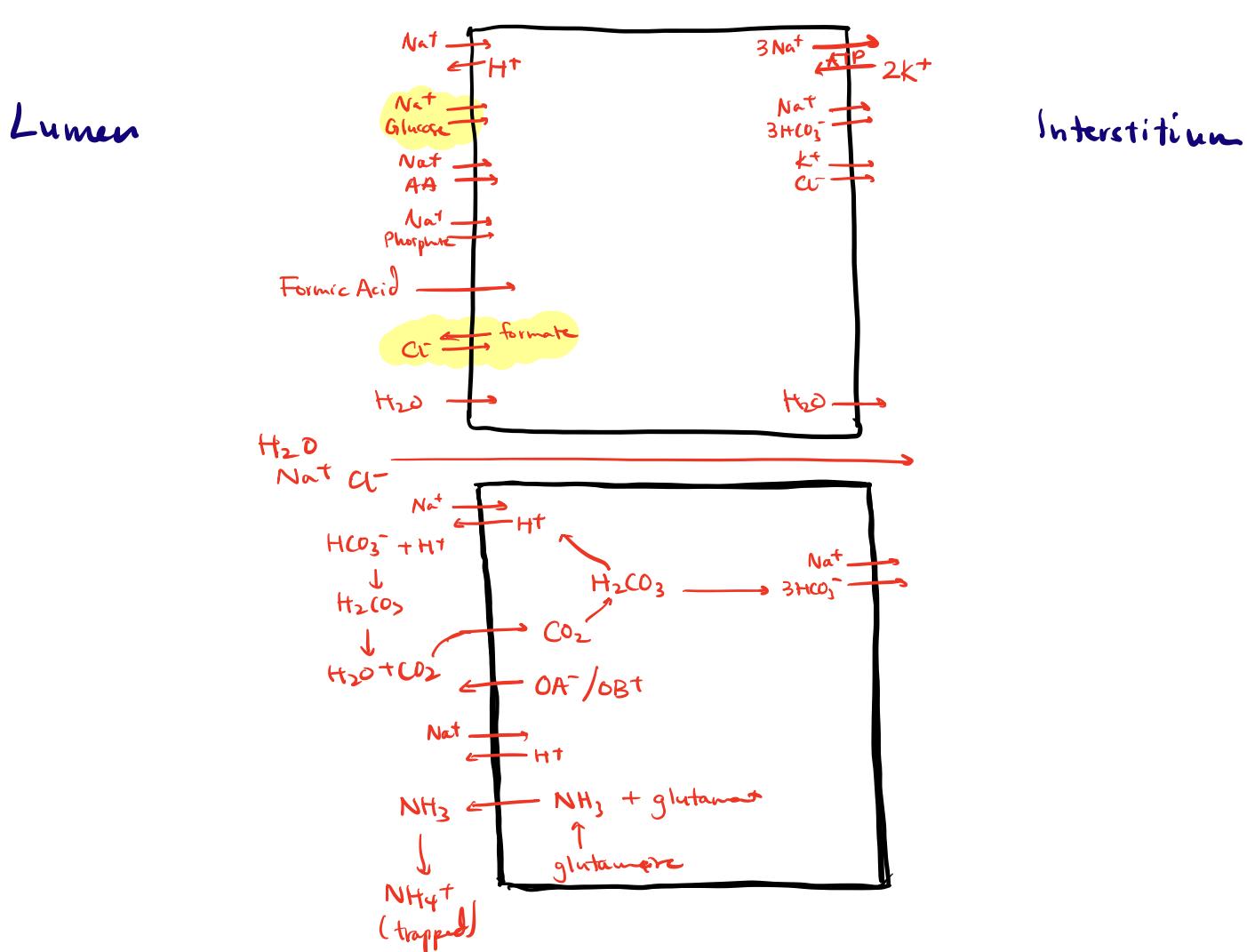
Functions of the Renal Tubule

Proximal Tubule

- Reabsorbs ~60% of $\text{Na}^+/\text{H}_2\text{O}$ (leaky epithelium)

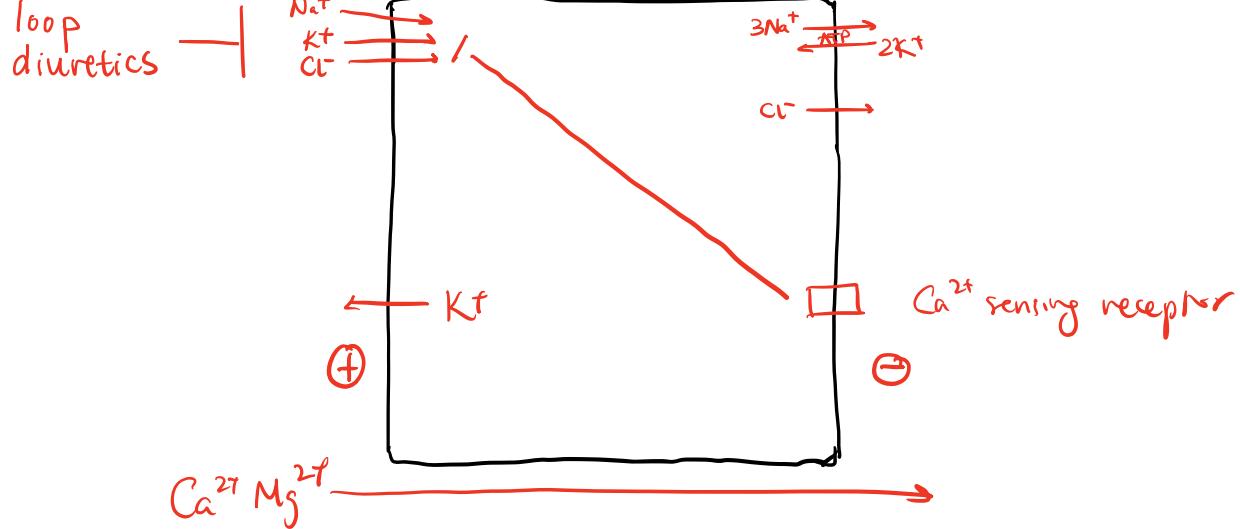
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- Reabsorbs 100% of filtered nutrients (glucose, AA, ...)
 - Reclaims 90% of filtered bicarbonates (not reabsorbed)
 - Endocytoses small peptides
 - Secretion of organic acids / bases
 - Trapping of H^+ via ammonia production for secretion
- } isoosmotic



Loop of Henle

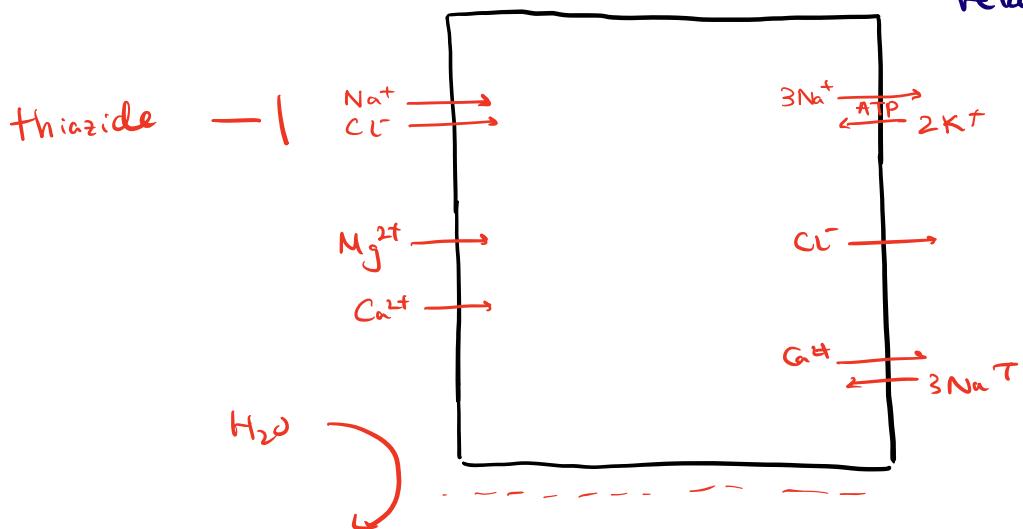
- Reabsorbs 15-25% filtered $NaCl$
- Creates hypertonic medullary interstitium \rightarrow countercurrent multiplier
- Descending limb \rightarrow highly water permeable (aquaporin channels)
- Ascending limb \rightarrow highly water impermeable
- Reabsorbs Mg^{2+} , Ca^{2+}



Distal Convoluted Tubule

- Reabsorbs $\sim 5\%$ filtered NaCl
- Tight epithelia
- Mg^{2+} , Ca^{2+} reabsorption
- thiazide diuretics target

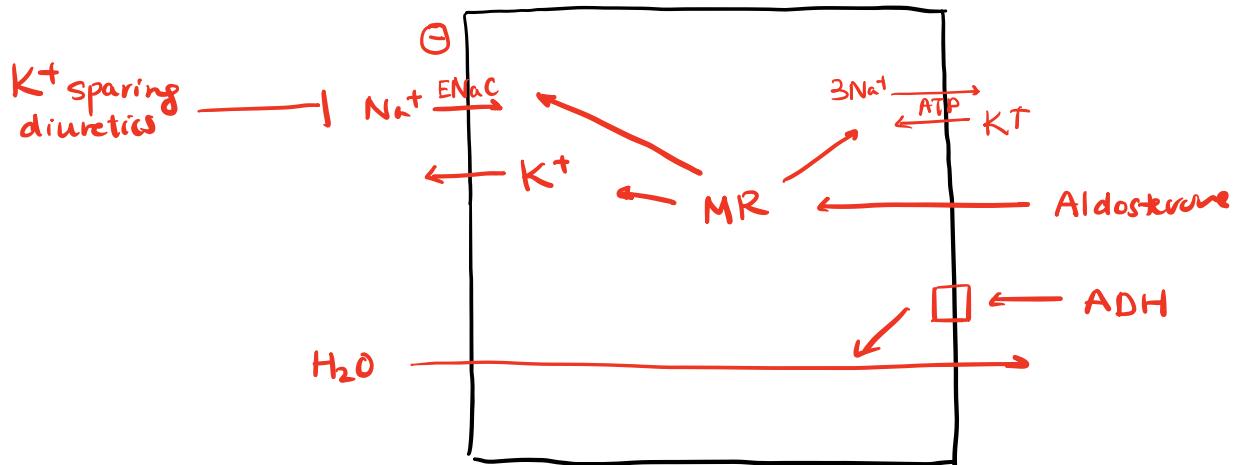
Ca^{2+} reabsorption inversely related to Na^+ reabs.



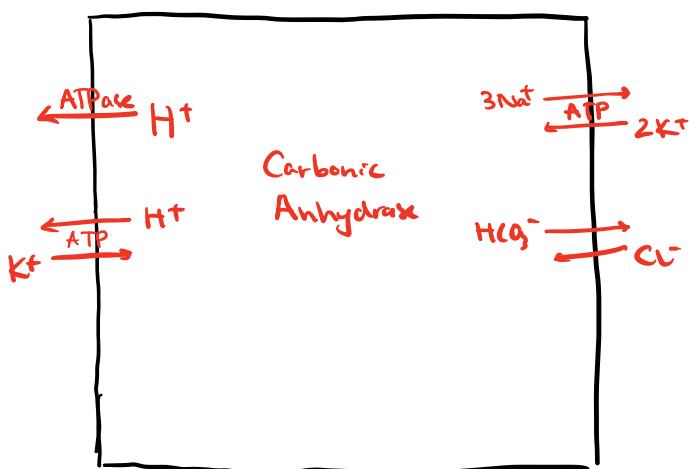
Cortical Collecting Duct

- Reabsorbs $\sim 4\%$ of filtered Na^+
- "fine tuning" Na^+ and K^+ excretion
- site of action for aldosterone
- acid/base excretion/reabsorption (intercalated cells)
- water permeability via ADH

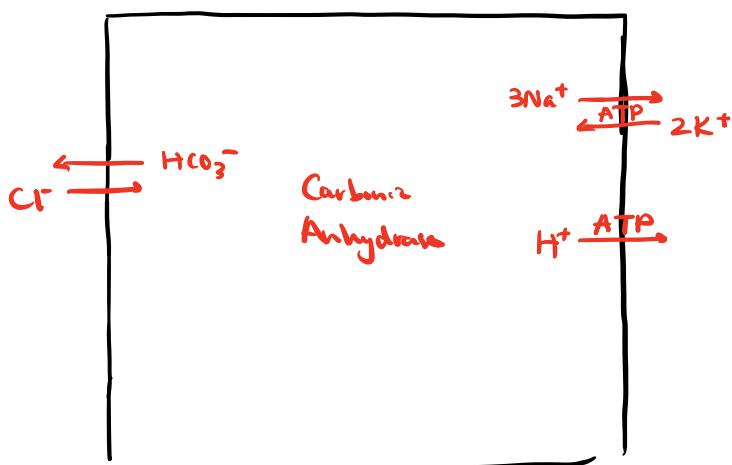
Principal Cell



Type A Intercalated Cell A = Acid Secreting



Type B Intercalated Cell



Inner Medullary Collecting Duct

- vasopressin mediated water reabsorption
- site of action of natriuretic peptides (ANP, natriuretic)
- urea recycling

